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ABSTRACT

A study that forecast the consequences of the projected growth in the number of practicing U.S. physicians during the 1980s and beyond is summarized. Attention was directed to the potential impact of the increasing supply of physicians on physician behavior, the cost of medical services, and access to services. Econometric modeling and analysis of economic activity within the health sector were undertaken. A four-equation model of the physician and hospital service market and a three-equation model of the dental service market were employed. Subsidiary modules covered: registered nurse graduates, general hospital beds, and annual medical and dental school enrollments. A disequilibrium model of the geographic diffusion of new additions to the stocks of physicians and dentists was also used. Attention is directed to: modeling assumptions, private sector demand, government expenditure functions, supply of physician and hospital services, and equilibrium in hospital and physicians markets. Forecasts are presented regarding: cost of physician and hospital services, total expenditures on hospital and physician services, real private insurance expenditures and government expenditures on physician and hospital services, third party reimbursements, and out-of-pocket expenditures. Findings are summarized. (SW)

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EXECUTIVE SUMMARY

1. Scope and Purpose of this Study

The purpose of the research reported here is to forecast the consequences of the projected growth in the number of practicing physicians in the United States during this decade and beyond. The implications of the projected growth in the national physician stock has been the subject of intense debate among economists. A number of competing hypotheses have emerged to explain and predict the economic impact of more doctors. This debate has intensified recently following the pronouncement by a government-sponsored commission (The Graduate Medical Education National Advisory Committee, GMENAC, 1980) that the nation will experience an increasing "surplus" of physicians in the future unless direct action is taken to reduce medical school enrollment. This study is a response to a Request for Proposals issued in 1982 by The Health Resources Administration (which administers health manpower legislation through its Bureau of Health Professions). The study was to analyze the potential impact of the increasing supply of physicians on physician behavior, access to and the cost of medical care. The final report is the result of that study.

Two major features of the study are its high level of econometric modeling and its detailed consideration of economic activity within the health sector. Our approach allows us to investigate the interactions within and between the health sectors while we forecast the consequences of the projected increase in physician supply. Readers interested only in the specific findings are referred to the final section that begins on page 17.

In the broadest possible terms our study found that the health care sector is experiencing a new and unique round of competition. Our model forecasts that the industry will react to new and increased levels of competition in the same way that industries such as finance, telecommunications and transportation have reacted. The only unique factor in the health care industry is its lack of experience in reacting to competition.

2. Methodology

The analytic approach of this study focuses on the interrelatedness of the principal factors. Namely, it emphasizes that the impact of the increasing stock of physicians on each particular variable of interest cannot be assessed independently of the impacts on all

the other variables. From the formal modeling standpoint, explicit recognition of the interrelatedness of these variables requires a simultaneous equation approach to develop a forecasting model which predicts the responses of the physician service market to the projected growth in the number of physicians. Furthermore, the behavior of physicians and changes in the physician service market cannot be considered in isolation from other sectors of the health system. Interdependencies among the various health markets must also be considered in order to understand and predict changes in the physician service sector. In particular, changes in the hospital industry will undoubtedly have profound effects on the behavior of physicians and the delivery of medical services, so the forecasting model must consider the simultaneous relationships between the physician and hospital markets.

The approach proposed for the study was to build on a previous Time Series Modeling Project of the Health Resources Administration staff who were investigating the applicability of orthodox economic concepts to the medical care industry using econometric models of supply and demand for various health services and manpower. At the time the current project began, the models available consisted of two main modules based on

aggregate time series data, and five subsidiary modules which forecast some of the exogenous variables for the two main modules.

In the discussion that follows "exogenous" means not explained by the model or outside the scope of the model. An "endogenous" variable is one that is explained by and therefore forecast into the future by the model. The two main modules are:

I. A four-equation model of the physician and hospital service market

II. A three-equation model of the dental service market

Early versions of modules I and II are described in "The Aggregate Supplies and Demands of Physician and Dental Services," by Jesse S. Hixson and Nina Mocniak published in the Target Income Hypothesis and Related Issues in Health Manpower Policy, DHEW Publication No. (HRA) 80-27. The endogenous variables of module I are prices and aggregate real expenditures on physician and hospital services; those of module II are prices and aggregate real expenditures on dental services.

The five subsidiary modules are:

1. A three-equation model of annual Registered Nurse Graduates

2. A stock-adjustment model of the annual number of short-term general hospital beds
3. A stock-adjustment model of annual dental school enrollment
4. A stock-adjustment model of annual medical school enrollment
5. A disequilibrium model of the geographic diffusion of new additions to the stocks of physicians and dentists.

The simultaneous equation model of the physician and hospital service markets was expanded to take into account a number of explicit considerations of interest to the government with respect to the expanding supply of physicians. This expansion yielded information about the structure, conduct, and performance of the industry which in turn afforded inferences regarding the effect of physician supply on their competitive action their pricing and supply behavior, and the effect of anticipated exogenous changes and developments in the hospital industry on the physician services market. The model yielded direct estimates of the impact of the expanding supply of physicians on medical care prices and expenditures, and on the composition of expenditures by sources of payment (i.e., private third party, out-of-pocket, and government).

The major theme of the current project was the interrelatedness of the variables that are influenced by the expanding physician stock and the mutual dependencies between the physician and hospital sectors of the health care industry, thus the decision was made not to add detail to the model that required a departure from the full simultaneity of the estimation of its structural relationships. Nevertheless, because the estimated structural relationships exhibit characteristics consistent with orthodox theoretical expectations, much can be inferred from the model about the qualitative properties of the industry's structure and microeconomic behavior consistent with it.

A technical description of the simultaneous equation model that was developed and used for the analysis and forecasts in this project is provided in the Technical Appendix of the full report. Similar descriptions of the auxiliary modules are available from the Modeling and Research Branch of HRSA where they were developed. The remainder of this section contains a non-technical discussion of the completed model.

3. Modeling Assumptions

The fundamental modeling assumption in this study is that conventional economic and econometric analysis can be used to model the health care industry. Specific account has been taken of special aspects of the health care industry, such as third party domination of the reimbursement system. However, our assumption is that conventional economics applies to professionals in the health care services industry as it does to lawyers in the legal services industry, accountants in the accounting services industry and pilots in the airline transportation industry. This is the economic equivalent of assuming one set of physical principles applies on every planet and we do not need a special science of physics for each planet or star.

The model is developed utilizing conventional supply and demand analysis; we assume the conflicting pressures of supply and demand will be resolved with the adjustment of prices and adjusted service levels over time. When outside forces cause disequilibrium to occur, this "instability" is resolved through the interaction of patients, providers, government institutions and private health insurance firms.

An additional modeling assumption concerns the

expected future paths of exogenous variables. Every model has variables that are determined by the model, and variables that are outside its scope. Real income is an example of a variable or economic influence that this health care model does not explain. Prices of physician services is a variable or economic result that the model attempts to explain and forecast. In order to forecast the future values of the endogenous variables we need future values for the exogenous variables. This is a requirement for all econometric models.

We use three general procedures for obtaining predicted values for the exogenous variables. The first procedure is to use the forecast from another model as an input to this model. We only use models that are appropriate for this purpose and ones that are "open." ("Open" in the sense that outside independent scholars had access to the models and they were not black boxes.) The second procedure is to adopt projections or forecasts from HRSA or other governmental agencies. Our third method utilizes a time trend or constant values for the exogenous variable where the first two approaches were not available. The data section of the final report contains a detailed discussion of the methods used to obtain these assumed values for the exogenous variables.

4. Private Sector Demand

Families base their health care decisions on their expectations of physician and hospital expenditures. When planning health expenditures they choose between out-of-pocket (both uninsured and co-pay plus deductibles) and insured expenditures. Of course the individual family attempts to maximize its well being. The model identifies a change in the distribution of expenditures from those paid by private insurance and direct payments to those financed or subsidized by the government.

The real cost to the individual is the after tax expected cost of health expenditures. Because employees and their families can receive tax free wage income in the form of health insurance or health benefits, they prefer to have health care services paid by their employer. This special tax treatment of health expenditures contributes to an explanation of why most health insurance is purchased by employers as "agents" for their employees and little if any auto or home insurance is purchased this way. In effect, this is a subsidy that promotes the consumption of health services in our model. In this model employers, like business firms, seek to maximize profits, and other organizations seek to minimize cost for a given level of output. This results

in pressures on all organizations (including profit seeking, non-profit and governmental) to pay the tax exempt income to their employees.

Below is a list of exogenous variables used in the model. Detailed discussions of the particular variables, their economic interpretation and utilization in the model are presented in the Appendix of the final report.

- Own price
- Lagged own price
- Cross price
- Percent of expenditures insured
- Population
- Unemployment rate
- Medicare-medicaid
- Marginal tax rate
- Real disposable income

5. Government Expenditure Functions

Both private sector economic decisions of individuals and public choice mechanisms connected with large scale government activities in health care are operative in this sector. Our model is based on the combined influence of private decision making and governmental regulatory and enforcement impacts.

The major Federal Government programs in this area are Medicare and Medicaid. These programs provide in-kind transfers of health services to the eligible aged or poor population. Our model specifies two impacts of these and all other governmental health service expenditures. The first is a stimulative effect which is

similar to one we would see if these groups received cash grants or increases in income. The second effect is the possible substitution of government expenditures for private insurance and private out-of-pocket expenditures. Our disaggregation allows us to test the hypothesis that Medicare and Medicaid have reduced reliance on private health care expenditures.

Our model also anticipates that macroeconomic activity or the business cycle influences governmental expenditures. One hypothesis is that people who are unemployed for a sufficiently long period lose their in-kind wage payments in health services. This effect would cause a reduction in health services in periods of long-term or deep recession. An alternative hypothesis is that individuals find other employment within the policy grace period, continue their health coverage from savings, or purchase health services directly. With the high level of two employee households, it may be that spouse coverage is switched from one carrier to another.

The variables included in the government expenditures equations are listed below. We have again adopted the strong assumption that the same fundamental economic forces influence both hospital and physician services. As before, this places emphasis on the economic analysis and allows little chance for ad hoc curve fitting.

The exogenous variables are:

- Real disposable income
- Population over 65 years
- Population under 65 years
- Own price
- Lagged own price
- Unemployment rate
- Medicare-Medicaid

6. Supply of Hospital Services

The supply side of the model posits one supply equation for hospital services and a separate supply equation for physician services. Hospital services are supplied by a heterogeneous group of diverse organizations. However, at the national level, the overriding economic forces influencing all hospitals are the ones that are assumed to be dominant in all hospital activities. Each organization is assumed to minimize the expected cost of producing a given expected quantity of services.

Supply of hospital services in the national time-series model is derived from the marginal cost schedules of the various hospitals. Hospitals are assumed to receive a major portion of their revenues from third parties. Their rates are assumed to be established on cost based reimbursement systems. Lagged prices would serve the same economic purpose as current prices in other econometric models, and current prices are a

proxy for current costs. As costs increase, these organizations must reduce output or other service related characteristics in response to increases in costs (holding all other influences constant). We also hypothesize that labor costs for nursing personnel can be statistically separated from the other costs in our hospital supply equation. The general cost variable and the nurse labor expenditure variable are hypothesized to comprise a satisfactory representation of relevant costs at the national level.

One industry supply response to changes in economic conditions is to increase or decrease the stock of short-term hospital beds. In our model, the long-term bed influence is held constant and serves only as a control variable. Increases in favorable economic conditions connected with hospital operations are met by increases in the stock of short-term beds. This can be the result of government or third party systems that promote more beds or increases in other economic conditions influencing hospitals. Its economic result is analogous to an increase in the number of firms, plants, or operating facilities in orthodox economic analysis.

7. Supply of Physician Services

As in the hospital equation, physician services supply is modeled as one equation in our system of simultaneous equations. The following variables are included in the equation:

- Own price
- Lagged own price
- Technological change
- Number of physicians
- Economic Stabilization Program
- Nurse graduates lagged

The price index for physician services has the same purpose as the hospital price index has in the hospital equation. "Prices," although to a smaller extent, are also based on a lagged or retrospective cost. The usual, customary and reasonable provisions of third party reimbursement systems have a well-known lag structure. Current prices also serve the same function as representing current practice costs of operation.

One of the central elements of the model is the impact of the growing stock of physicians. The total number of physicians is used in preference to practicing or full-time or active physicians because these other measures are endogenous variables in a correctly specified model. Stated differently, economic conditions influence the work activities of physicians and the decision to remain in practice. These conditions and

other economic decisions would be intertwined within the model, not outside of it. However, the total number of physicians is a capacity variable that is based on decisions made at least seven to ten years ago. It is much less sensitive to current economic conditions than numbers of practicing physicians.

A second point is that we resist the temptation to introduce a physician supply variable into all equations of the system. It might be argued that the number of physicians belongs in the hospital supply equation. However, if we had taken that approach, we would have used physician wage data in the reduced form cost function as developed by Shephard and Uzawa. The simultaneous relations that our model incorporates are the relations between the physician sector and the hospital sector. In this way we have, in fact, accounted for the interrelations between the physician sector and the hospital sector, and not confounded the hospital bed model.

8. Equilibrium in Hospital and Physician Markets

Three separate demands in the hospital services sector are aggregated to form total hospital services demand. In equilibrium, total hospital service demand is equal to total hospital services supply. Total physician

services demand is modeled in the same way. Equilibrium in the physician services sector is achieved when total supply equals total demand. The system of supply and demand equations is solved simultaneously. This means that both the hospital and the physician sectors interact at each sample point. This is in contrast to the situation where all demands are aggregated to form one aggregate demand for total health care and one aggregate supply is postulated. We preserve the interactions between sectors when estimating the parameters of all eight equations simultaneously.

The final step in our modeling process is to obtain the computed values for the endogenous variables. As is easily seen, the equations alone do not allow the forecast of any endogenous variables. The equations must be solved simultaneously using analytic methods. We solve the system for the endogenous variables in terms of the estimated parameters and the exogenous variables. Our forecasts are based on those estimated parameters for all periods. Forecasts made within the sample period are based on actual exogenous variables, and forecasts outside the period are based on the projected paths of exogenous variables.

The model includes lagged endogenous variables, and for this reason values are entered into the forecasts in a two-step process. The first step is to obtain the price

index forecasts based on all exogenous variables. The second step is to use those price forecasts as if they are exogenous values in the one period ahead forecasts. This method is often used in dynamic simulations.

9. Compilation of Findings

A major finding of this study is that the structure and estimated parameters of our model are consistent with orthodox economic analysis. Because of this, much can be inferred from the model about the qualitative nature of the economic activity resulting from the growing number of physicians. A second finding is that because we developed a fully simultaneous integrated system of equations, the impacts of more physicians in one sector is transmitted to other sectors as well. The result is a model that is not only estimated using simultaneous methods, but the forecasted values are obtained by solving the system of equations simultaneously to obtain the equilibrium values for the variables of interest.

The estimated model allows us to test specific hypotheses concerning the operation of the health care sector. It also allows us to make forecasts concerning the long run impact of the growing number of physicians on the cost of health care, the behavior of providers, and the changing access to health care.

9.1 Findings Concerning Cost

The term physician "surplus" is a misnomer because we found no evidence that disequilibrium exists. The increase in the supply of physicians will exert pressures on physician incomes and physician service prices. However, this is only one of the elements contributing to pressures on physician incomes and health care costs. The model forecasts the following impacts as a result of the growing numbers of physicians and the changing economic patterns in the health care industry.

- Cost of Physician and Hospital Services

Future price index increases in physician services will be moderated, but a cyclical pattern detected by the model will continue. The rate of hospital price (index) acceleration will be dramatically reduced from historical trends. However, they are forecast to be substantially above the general price inflation through the next decade.

- Total Expenditures on Hospital and Physician Services

Growth in inflation adjusted total expenditures on physician services will be significantly below their historical trends. Total real expenditures on hospital services will maintain their historical trend. Total medical expenditures as a percentage of disposable income are forecast to increase throughout the next decade, as

are its two components: hospital expenditures and physician expenditures. The expansion paths of these latter two series are relatively modest in the near term with cost growth increasing in the early 1990's.

. Components of Total Expenditures on Health Care Services

Total health care expenditures are defined as the sum of private insurance expenditures, government expenditures and direct or out-of-pocket payments. The latter are composed of deductibles and copayments for public and private insurance programs. This category also includes payments for health expenses by those without health insurance.

. Real Private Insurance Expenditures on Physician and Hospital Services

Inflation adjusted expenditures on hospital services exhibit weak long wave cycles. These expenditures are forecast to increase at a constant rate to the mid 1980's and then increase and finally decrease at the beginning of the 1990's. Real private insurance expenditures for physician services will increase in the near term and then be subject to downward pressures. However, these pressures will only reduce the rate of increase rather than reduce the level of inflation adjusted expenditures on physician services.

- Real Government Expenditures on Hospital and Physician Services

The model predicts that inflation adjusted government expenditures will grow at their historical long-term rate. Real physician expenses paid by all levels of government will grow at a lower rate than in the post medicare era and at a substantially lower rate than most recent past.

- Third Party Reimbursements

Private insurance payments plus government payments represent total third party payments. Our model predicts that inflation adjusted third party payments for hospital services will parallel their historical trends but at a lower level. Competitive pressures on physician expenditures will be stronger and total third party expenditures are forecast to increase at rates much below their recent records and their post medicare historical trend.

- Out-of-Pocket Expenditures

For technical reasons related to the way the data are obtained, real out-of-pocket expenditures for all health care expenses show the most variability. The model is specifically tailored to be compatible with the residual nature of direct expenditures. Care should be exercised in making detailed inferences from these data. Nevertheless, the model generally tracks these

series well. Inflation adjusted direct payments for hospital services are forecast to grow at rates faster than their historical trends. This may be a result of the changing mix of hospital services under future competitive market structures. Out-of-pocket expenditures on physician services are also expected to increase at faster rates than seen in the most recent past. However, the acceleration or explosive growth we have seen recently in this category has apparently ended as a result of the growing numbers of future physicians.

9.2 Findings Concerning Physician Behavior

In response to the increasing numbers of physicians, we will see increasing levels of competition among physicians and within the hospital sector. In addition, we will see competition between physicians, physician groups and hospitals. Third party payers will react to exploit this market situation. The net result of this competition is seen in our forecasts. How this behavior occurs is one element of market conduct. Our model is consistent with change in the health care industry, but not with radical behavioral change. While competition is new to the health industry, our findings are consistent with those of an industry facing new competitive opportunities and challenges. In this regard the health care industry might

look to transportation, telecommunications, or finance to see the ways in which other basic service industries have reacted to increased competition.

. Pricing Behavior

Relative prices of physician services have not followed a smooth upward spiral; rather they have a cyclical pattern which is apparently independent of macroeconomic cycles as measured by the National Bureau of Economic Research.

Physician prices are more volatile than hospital prices. This difference may be related to competitive conditions and the reimbursement system. Changes to the competitive structure or reimbursement system would likely result in increased responsiveness of prices.

. Forms of Competition

We found that after direct price competition, a whole array of competitive strategies and tactics of physicians can be expected to occur in the increasingly competitive health care industry (sections 5.1 and 5.2 of the final report detail the most likely forms they may take). A general impact of increased numbers of physicians is predicted to be experimentation and diversity of delivery of health services. Those innovations that meet the market test will spread. Limits on the actual forms of competition depend upon the creativity and ingenuity of physicians and their advisors.

9.3 Findings Concerning Access to Health Care

The final report documents how the changing competitive structure of the industry leads to changes in behavior which, together with general business conduct in the health care industry, results in changes in economic performance. One element of the economic performance of the health care industry is access to care. We found that a significant improvement in access will occur as a result of the increase in the numbers of physicians.

General Definitions of Access To Health Care

A composite definition of access might be: "access to health care means people find no excessive hardships in obtaining adequate health care and that costs are distributed fairly."

We found this definition unsatisfactory because it implies a community either has or does not have "access." Such a definition is based on the subjective opinion of the evaluator and is therefore difficult to measure on a scientific basis. The question for economists is "How is this industry performing?" The answer to that question is difficult for any industry. We propose comparing access to health with access to other products and services in the economy. Until such a comparative analysis is conducted, we propose looking at two broad areas--Financial Access and Functional Access.

. Financial Access and the Increase in Physicians

Our econometric model forecasts that more practicing doctors will mean more health care and the increase in the supply of services will retard the acceleration of both physician and hospital price indices. However, the growth in these two series is predicted to exceed the national inflation rate. More real resources will be devoted to the health care sector of the American economy. However, we note that the impact of DRG's or other changes to the hospital reimbursement system were not modeled. After the budget neutrality period, these regulatory changes could have significant impacts.

Access is often discussed in terms of physician and hospital insurance. Our findings are consistent with the theory that massive health insurance is a product of the tax system and not the health system. Our statistical results also indicate that medicare and medicaid reduces reliance on private insurance and that disposable income is a major determinant of financial access, as measured by insurance expenditures.

Financial access can also be measured by government activities in health. While much concern is expressed about how well the private sector is meeting national needs, the public sector can also be included. Access as measured by inflation adjusted government expenditures

is forecast to increase through the 1980's. Hospital expenditures will increase at a rate equal to their historic trend. Physician expenditures are predicted to grow at a reduced rate principally due to the impact of competition on the physician sector. The slowing of growth rates results in both considerable expansion of government programs in real terms and in increased access to care.

Total third party payments are the arithmetic sum of private insurance expenditures and government expenditures. In the sense that they indicate continuing access to health care through our current system, they are a measure of access. We found that the impact of increased numbers of physicians resulted in increased access in both hospital and physician sectors.

More reliance on direct or out-of-pocket expenses is also predicted by the model. As competition increases, driven by increases in physician manpower, increasing amounts will be spent on direct expenditures. One reason is that consumers will find that they can obtain services which better meet their needs outside the third party reimbursement system. A second reason is that increased co-payments and deductibles will be expected to prevail as expenditures grow.

Functional Access to Health Care

One of the most critical access issues concerns the geographic distribution of health care professionals.

One of the implications of our time-series model is that we will have more competition. As a result, new entrants to the profession will find it increasingly difficult to enter highly doctored areas. To analyze this issue we developed a county level cross section/time-series model.

This econometric model indicates that competition leads to a changing geographic distribution of primary care physicians. In effect, access will improve throughout our forecast period to 1990.

We disaggregated the total by a metropolitan and nonmetropolitan classification. Nonmetropolitan counties predominate, amounting to 85 percent of the total. The differences in these rates indicate that competition is active in both county classifications.